

The invention claimed is:

1. A process for the treatment of light cracked naphtha, containing organic sulfur compounds, comprising the steps of:
 - (a) fractionating a light cracked naphtha and recovering a first higher boiling naphtha fraction;
 - (b) feeding hydrogen, a heavy cracked naphtha and said first higher boiling naphtha fraction to a distillation reaction zone containing a hydrodesulfurization catalyst;
 - (c) concurrently in said distillation reaction zone:
 - (i) reacting a portion of said organic sulfur compounds with hydrogen to produce hydrogen sulfide, and
 - (ii) separating a lower boiling naphtha fraction containing said hydrogen sulfide and a second higher boiling naphtha fraction containing said heavy cracked naphtha by fractional distillation;
 - (d) removing said lower boiling naphtha fraction from said distillation reaction zone as overheads;
 - (e) removing the hydrogen sulfide from said second overheads; and
 - (f) removing said second higher boiling naphtha fraction, containing less sulfur than said heavy cracked naphtha, from said distillation reaction zone.
2. A process according to claim 1 wherein at least a portion of said second higher boiling naphtha fraction is recycled to said distillation reaction zone.
3. A process for the treatment of light cracked naphtha comprising the steps of:
 - (a) feeding hydrogen and a light cracked naphtha containing olefins, diolefins, mercaptans and heavier organic sulfur compounds to a first reaction zone containing a thioetherification catalyst;
 - (b) reacting a portion of the mercaptans with a portion of the diolefins to produce sulfides;
 - (c) separating a first lower boiling naphtha fraction of the light cracked naphtha from a first higher boiling naphtha fraction of the light cracked naphtha by fractional distillation, said higher boiling naphtha fraction containing said sulfides and said heavier organic sulfur compounds;

- (d) removing said first lower boiling naphtha fraction as a first overheads, said first lower boiling naphtha fraction having a reduced total sulfur content from said light cracked naphtha;
- (e) removing a first higher boiling fraction as a first bottoms from said distillation;
- (f) feeding hydrogen, a heavy cracked naphtha and said first bottoms to a distillation reaction zone containing a hydrodesulfurization catalyst;
- (g) concurrently in said distillation reaction zone:
 - (i) reacting a portion of said sulfides and heavier organic sulfur compounds with hydrogen to produce hydrogen sulfide, and
 - (ii) separating a second lower boiling naphtha fraction containing said hydrogen sulfide and a second higher boiling naphtha fraction containing said heavy cracked naphtha by fractional distillation;
- (h) removing said second lower boiling naphtha fraction from said distillation reaction zone as a second overheads;
- (i) removing the hydrogen sulfide from said second overheads;
- (j) combining said second overheads with said first overheads to produce a low sulfur product;
- (k) removing said second higher boiling naphtha fraction containing less sulfur than said heavy cracked naphtha, from said second distillation reaction zone as a second bottoms;
- (l) recycling at least a portion of said second bottoms to said distillation reaction zone.

4. The process according to claim 3 further comprising the steps of:

- (m) feeding said first overheads and hydrogen to a single pass reaction zone containing a hydrodesulfurization catalyst wherein additional mercaptans and organic sulfur compounds are reacted with hydrogen to produce additional hydrogen sulfide; and
- (n) separating said additional hydrogen sulfide from the effluent from said single pass reaction zone.

5. The process according to claim 3 wherein the ratio of said first bottoms to said heavy cracked naphtha is between 2:1 and 4:1.

6. A process for the treatment of light cracked naphtha comprising the steps of:

- (a) feeding hydrogen and a light cracked naphtha containing olefins, diolefins, mercaptans and heavier organic sulfur compounds to a first distillation reaction zone containing a thioetherification catalyst;
- (b) concurrently in the first distillation reaction zone:
 - (i) reacting a portion of the mercaptans with a portion of the diolefins to produce sulfides and
 - (ii) separating a first lower boiling naphtha fraction of the light cracked naphtha from a first higher boiling naphtha fraction of the light cracked naphtha by fractional distillation, said higher boiling naphtha fraction containing said sulfides and said heavier organic sulfur compounds;
- (c) removing said first lower boiling naphtha fraction as a first overheads from said first distillation reaction zone, said lower boiling naphtha fraction having a reduced total sulfur content from said light cracked naphtha;
- (d) removing said first higher boiling fraction as a first bottoms from said first distillation reaction zone;
- (e) feeding hydrogen, a heavy cracked naphtha and said first bottoms to a second distillation reaction zone containing a hydrodesulfurization catalyst;
- (f) concurrently in said second distillation reaction zone:
 - (i) reacting a portion of said sulfides and heavier organic sulfur compounds with hydrogen to produce hydrogen sulfide, and
 - (ii) separating a second lower boiling naphtha fraction containing said hydrogen sulfide and a second higher boiling naphtha fraction containing said heavy cracked naphtha by fractional distillation;
- (g) removing said second lower boiling naphtha fraction from said second distillation reaction zone as a second overheads;
- (h) removing the hydrogen sulfide from said second overheads;
- (i) combining said second overheads with said first overheads to produce a low sulfur product;
- (j) removing said second higher boiling naphtha fraction containing less sulfur than said heavy cracked naphtha, from said second distillation reaction zone as a

second bottoms;

(k) recycling at least a portion of said second bottoms to said second distillation reaction zone.

7. The process according to claim 6 wherein a portion of said second bottoms is removed as a purge.

8. The process according to claim 7 wherein said heavy cracked naphtha is fed to said second distillation reaction zone at a rate to make up for the portion purged.

9. The process according to claim 6 wherein said second distillation reaction zone contains an upper bed of hydrodesulfurization catalyst above a feed point and a lower bed of hydrodesulfurization catalyst below the feed point.

10. The process according to claim 9 wherein said thioetherification catalyst comprises a bed positioned in an upper portion of a distillation column reactor.

11. The process according to claim 9 wherein the second lower boiling naphtha fraction is distilled into the upper bed and the second higher boiling naphtha fraction is distilled into a lower bed.

12. The process according to claim 6 further comprising the steps of:

(l) feeding said first overheads and hydrogen to a single pass reaction zone containing a hydrodesulfurization catalyst wherein additional mercaptans and organic sulfur compounds are reacted with hydrogen to produce additional hydrogen sulfide; and

(m) separating said additional hydrogen sulfide from the effluent from said single pass reaction zone.

13. The process according to claim 9 wherein the catalyst in said upper bed comprises cobalt and molybdenum oxides supported on an alumina base and the catalyst in said lower bed comprises nickel and molybdenum oxides supported on an alumina base.

14. The process according to claim 6 wherein the ratio of said first bottoms to said heavy cracked naphtha is between 2:1 and 4:1.

15. In a process for treating a higher boiling naphtha fraction of a light cracked naphtha to remove organic sulfur compounds comprising:

(b) feeding hydrogen and said higher boiling naphtha fraction of a light

cracked naphtha to a distillation reaction zone containing a hydrodesulfurization catalyst;

(c) concurrently in said distillation reaction zone:

(i) reacting a portion of said organic sulfur compounds with hydrogen to produce hydrogen sulfide, and

(ii) separating a lower boiling naphtha fraction containing said hydrogen sulfide and a second higher boiling naphtha fraction by fractional distillation;

(d) removing said lower boiling naphtha fraction from said distillation reaction zone as overheads;

(e) removing the hydrogen sulfide from said second overheads; and

(f) removing said second higher boiling naphtha fraction from said distillation reaction zone;

wherein the improvement comprises feeding a heavy cracked naphtha in step (b) and removing said heavy cracked naphtha in said second higher boiling naphtha fraction in step (f) whereby said second higher boiling naphtha fraction contains less sulfur than said heavy cracked naphtha fed in step (b).

16. The process according to claim 15 wherein a portion of the second higher boiling naphtha fraction is recycled to step (b).